

and when practically all operable conditions will have been overlooked. It is particularly important to discover small polyps which have begun to show malignant change, for many of them can be removed with the cautery and the condition cured, saving the patient the loss of the rectum, which would be inevitable if not discovered very early.

There has been, in the past, much difference of opinion as to type of operation which should be performed for cancer of the rectum. There is, today, no difference of opinion as to the necessity of a permanent colostomy. Most surgeons now believe that the abdominoperineal resection of the sigmoid and rectum offers the best chance of cure. A few still maintain that a posterior resection following a preliminary colostomy is the better procedure because of a lower primary mortality. However, the technique of the abdominoperineal resection of the sigmoid and rectum in two stages has been so improved that, with the use of spinal anesthesia, the primary mortality has been reduced so that it is comparable with that of the posterior resection. Ernest Miles of London has shown that unless the three zones of spread (the upward, the lateral, and the downward) are completely removed, recurrence will be much more frequent. The posterior resection does not remove the upward zone of spread. The abdominoperineal resection does with practically the same primary mortality. The abdominoperineal resection should be done unless there are special conditions which preclude it in the individual case. Without question the posterior excision in either operation should be done with the cautery.

### EPIDEMIC CEREBROSPINAL MENINGITIS\*

A REPORT OF SEVENTY-ONE CASES, WITH OBSERVATION OF CERTAIN PHASES OF THE RECENT UTAH EPIDEMIC

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**D**URING the course of an epidemic, one obtains certain impressions which, because of lack of proper perspective, are frequently erroneous. Correct deductions regarding disease can only be made by careful study of case histories, tabulation, and comparison with other series of cases.

#### TIME PERIOD COVERED

This is a brief report of a series of cases of epidemic cerebrospinal meningitis treated by a few members of the staff of the Salt Lake General Hospital during the years 1927, 1928, and the first three months of 1929. During this period epidemic meningitis has been increasingly prevalent in Salt Lake City, as can be seen in Table 1, which also gives the number and per cent of the total number of cases in the city treated in this hospital. From this chart it will be seen that in the first three months of 1929 there have been considerably over twice as many cases as there were in 1928, and over six times as many as in 1927. The increase to epidemic proportions coincided

\* From the Contagious Department of the Salt Lake General Hospital.

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TABLE 1.—*Meningitis in Salt Lake City*

Year	No. Cases	Cases in General Hospital	Per Cent
1927.....	17	8	47%
1928.....	44	22	50%
1929*.....	104	41	39%
Total	165	71	45%

\* First three months.

with the reports coming from New York, Arizona, Iowa, Oklahoma, Alabama, Georgia, and Arkansas. Of the total number of cases occurring in the city, 45 per cent were treated in this hospital, whereas the remaining number of cases were scattered among the other physicians of this locality. It is easily seen from this that, save for the four or five physicians handling the disease at this hospital, any individual physician will see very few cases of meningitis indeed in the course of a number of years. This same condition maintains in practically any part of this country. Little wonder can be displayed, therefore, if the mortality rate for a hospital like the Salt Lake General Hospital, or other similar hospitals where there is constant experience in treating such cases, is appreciably lower than that of other hospitals where only an occasional case is seen, except during epidemics. In the former institution an organization is perfected and maintained for handling the disease, and therefore it is prepared at all times for an epidemic. This is a most important point, for meningitis is a disease which requires, above all, early, expeditious, well organized and systematized nursing and medical care.

#### MORTALITY FIGURES

Table 2 gives the mortality rate by the year. These compare very favorably with those in the report of the New York City Board of Health. The mortality figures of a hospital of this type are often lower, for the patients are often sent in for hospitalization later in the course of the disease than in other institutions. The fact that thirteen deaths of the total of forty-four occurred within twenty-four hours after admissions bears out this viewpoint. Omission of such deaths would give a corrected mortality per cent of 29.5. As a sidelight, it is interesting to note that in New York City, where so much of the serum used is that prepared by the City Board of Health (a serum considered by most authorities as more potent than the commercial products) the mortality rate was higher than that of this hospital, where the commercial sera were used.

TABLE 2.—*Percentage Mortality of Meningitis*

Year	Salt Lake General Hospital	New York City
1927.....	62.5%	67.8%
1928.....	35.4%	47.0%
1929.....	53.6%*	55.5%†
Total	47.8%	56.7%

\* First three months.

† First two months.

TABLE 3.—Day of Death After Admission				
Death Day	Year 1927	Year 1928	Year 1929*	Total
1	3	2	8	13
2	0	1	4	5
3	1	2	2	5
4	0	0	2	2
5	1	0	3	4
6	0	0	1	1
7	0	0	1	1
8	0	1	0	1
14	0	0	1	1
16	0	1	0	1
Total	5	7	22	34

\* First three months.

Regarding the day of death after admission (Table 3) it is seen that the greater number of patients died during the first twenty-four hours after admission to the hospital. In general there is a gradual drop up to the beginning of the sixth day, when a very pronounced decrease in the mortality occurs. One can assume, therefore, that the prognosis is directly proportionate to the number of days lived; and that if a patient survive five days he stands a very good chance of recovering.

The duration of the illness before admission to the hospital is shown in Table 4. The figures there given show clearly what is known only too well, that the earlier the admission the better the prognosis. Those admitted in the first two days of illness fared the best. However, even with early admission and with diagnoses made at a time when the spinal fluid changes are slight, one cannot be too sanguine as to the final outcome. This table also shows that in 1929 patients were admitted much earlier in the course of the disease. This was due undoubtedly to the presence of the disease in epidemic form, with the result that physicians were on the lookout for the condition and the lay citizens were sufficiently alarmed to request early medical attention.

AGE OF INCIDENCE

Certain findings are of interest in respect to the age of incidence. In New York City, prior to 1927<sup>1</sup> the disease predominated in the one to ten age group, with the ten to twenty age group a poor second. In our series, while the disease was most common in children under ten years of age, it was only slightly so, and incidence in the ten to twenty age group was correspondingly increased. In the epidemic this was strikingly noticeable, apparently affecting the high school patients more than any group. The most reasonable explanation for this is that children of this age are thrown into closer contact with one another, as at basketball games, dances, and other social gatherings,

TABLE 4.—Duration of Illness Before Admission			
Days Duration	No. Cases	No. Deaths	Percentage Deaths
1	16	5	31%
2	12	4	33%
3	11	5	45%
4	4	3	75%
5	1	1	100%
6	1	1	100%
7	1	1	100%
8	—	—	—
9	—	—	—
10	1	1	100%

TABLE 5.—Age Incidence		
Age Period	Salt Lake General Hosp. 1927-1929	New York City Prior to 1926
1-10	45%	72%
10-20	38%	15%
20-30	11%	08%
Above 30	05%	04%

than is the case with the younger children. The grammar school age was strikingly free from the disease, although the schools remained open. This only goes to substantiate the viewpoint that closing of schools is unnecessary and probably a folly, for if this is done the children will not have the close supervision of the teacher and school nurse, but instead will be more likely to expose themselves to uncontrolled gatherings and thus disseminate the organisms more thoroughly throughout the city. Prohibition of athletic contests, or at least audiences for such competitions, and keeping children from dances, theaters, and church gatherings will do more to combat the epidemic than closing the schools.

The average stay in the hospital of cured patients was eighteen days. The majority of the patients were ready for discharge on the fourteenth day, that is, by the time quarantine was up, positive throat cultures alone necessitating their residence in the hospital. In a few cases complicating infections or chronicity of the disease lengthened the duration of stay in the hospital.

SYMPTOMS

Mention will be made of only certain symptoms which seem to be of interest. Vomiting was not a very common symptom after admission to the hospital, although it was rather frequent before entrance. Herpes, and usually severe herpes of the face and lips, were exceedingly common, much more so than usually mentioned in textbooks. Petechiae were found in the majority of cases in 1929, and served to indicate the unusual virulence of the organism. Headache was present in practically all patients, as were the usual signs of meningeal irritation.

The temperature curves were generally of the intermittent type, and showed one peculiarity of which little mention has been made. About the third day after entrance most of the patients showed a drop of temperature, with a subsequent rise on the next day or the one following this. Whether this secondary rise in temperature indicated a reaction to serum or was a manifestation of bacterial recrudescence may be, perhaps, a matter worth discussing. In our opinion it was merely an indication that, while the serum given had temporarily overcome most of the infection, the bacteria again had gained the upper hand. The chief interest in this had to do with the treatment. Serotherapy should not be discontinued when the defervescence occurs at so early a stage. Undoubtedly this is the point at which most of the mistakes in treatment are made. Serotherapy should be continued, in spite of the drop, until one is satisfied that the temperature will remain

down, or until other indications for stopping treatment are present. A continued fever, especially if high, is of grave importance. When lower it may indicate the chronic form of the disease, or the presence of some other infection such as arthritis, otitis, adenitis, or pyelitis. About the seventh day an elevation of temperature frequently appears. This is probably a delayed anaphylactic reaction, usually associated with urticaria. While a high temperature speaks for a poor prognosis, such is not always the case, especially if there is a definite drop on the second or third day. The lowest temperature recorded was in a patient whose fever was never over 99.4 Fahrenheit, and the highest was 109 Fahrenheit, just before death.

#### COMPLICATIONS AND SEQUELAE

Thirty-seven patients recovered, and in this number urticaria was practically universal. Thirty per cent exhibited one or more other complications. Two patients were totally deaf on discharge, while four had impaired hearing, bilateral or unilateral. Panophthalmitis, unilateral, occurred in two patients, defective vision in one, and strabismus in one. Cervical adenitis was manifest in two patients. In one patient there was nearly total paralysis of the right arm. Arthritis and iritis were seen in one patient. One of the patients who was totally deaf on discharge regained part of his hearing. One patient who has been listed with the totally deaf is now complaining of ringing in the ears, signifying peripheral stimulation. It remains to be seen whether some hearing will return. Our experiences serve to corroborate the findings of Neal<sup>2</sup> and her co-workers that sequelae, especially the paralytic type, are much less common than ordinarily supposed.

Acute anaphylaxis occurred three times following intravenous administration of a highly concentrated serum. In two of the patients death was ascribed to anaphylactic shock. This reaction did not occur with intravenous administration of less concentrated sera.

#### PROGNOSIS

With serum treatment the mortality is ordinarily said to be 30 per cent. Neal, Jackson, and Appelbaum<sup>2</sup> report 23 per cent in 654 cases. In the hands of most observers, including ourselves, the mortality is approximately 50 per cent. Petechiae indicate a severe infection of the septicemic type.

As mentioned before, a high temperature usually, if prolonged, offers a grave prognosis, but conversely a low temperature does not give a universally good prognosis. The element of most prognostic value obtained from the temperature curve is the defervescence shortly after admission. If the secondary rise, which usually follows, is low and of short duration, the patient will probably recover.

A rapid thready pulse indicates a serious infection. The respiration rate, to our viewpoint,

seemed to be of more prognostic value than the pulse. A rapid rate or a sudden rise, indicating medullary pressure, are grave signs. Indications of intracranial pressure, rapid respirations, slow, bounding pulse, with later rapid thready irregular pulse, together with signs of marked increase of spinal fluid pressure or spinal block always offer a poor prognosis.

The spinal fluid is of some value in arriving at a conclusion as to the outcome of the disease. Thick fluids containing fibrin flakes indicate a severe infection. Excessive spinal fluid pressure is another grave sign, and when no fluid is obtained one can assume a basilar form, which is extremely fatal. A dry cisterna tap is of similar significance. Bloody fluids of nontraumatic origin indicate a severe infection.

We have observed a finding, hitherto apparently unrecorded, which seems to be of considerable prognostic value. Increasing rigidity of the neck or opisthotonos, especially when associated with a definite drop in temperature, is a favorable sign. One would ordinarily assume this to be a serious omen, but apparently this finding is not to be considered as due to an increase of the infection, but is rather a manifestation of increased meningeal irritation set up by the antimeningococcic serum.

#### TREATMENT

Treatment should be well systematized if best results are to be obtained. The disease requires constant nursing and medical attention, and poor results are inevitable if treatments are given irregularly and without a definite plan of procedure; or if nearly constant attention is not given the patient, especially after administration of serum. It is not uncommon for a patient to go into collapse shortly after administration of serum. Such attacks are not to be confused with anaphylaxis, although occasionally such an occurrence is experienced. They appear to be true manifestations of collapse and usually occur in those patients who resist treatment rather violently. In many instances prompt injection of epinephrin together with the use of artificial respiration and oxygen were life-saving procedures.

The spinal fluid is removed slowly until the pressure is normal and serum equal in amount to the fluid withdrawn is injected. In some instances this amounted to 60 cubic centimeters, although the average was 30 cubic centimeters. Depending upon the severity of the case, these injections were repeated at eight or twelve-hour intervals. For the severe cases three treatments were given the first twenty-four hours, twelve for the next two, or possibly three days, and one daily until there was a definite change for the better symptomatically and the fluid became clearer. Serum was then given every other day until the spinal fluid showed no spinal organisms. The average number of punctures was eight. Therapeutic punctures were occasionally done later for relief of pressure symptoms such as headache. In some

instances where a dry tap was obtained, serum could be gravitated into the spinal canal.

Intravenous administration of serum was used only for the severe septicemic forms, and then it was given only during the first twenty-four or thirty-six hours. Intramuscular injection of serum was given occasionally in the earlier cases, but was abandoned later. In a few instances babies were given serum intraperitoneally.

Cisterna puncture was reserved for those severe cases exhibiting spinal block or those desperately ill patients who showed signs of respiratory involvement. No hesitation was felt about giving serum very slowly by this route because of the gravity of the case. Only one patient died immediately following this procedure. This death was in a practically moribund child who had had two previous cisterna punctures. The last puncture resulted in a dry tap, indicating massive blocking of the base by exudate. Cisterna puncture, if used cautiously in selected cases, will save a few of the more serious cases. No ventricular punctures were done. In one instance this was indicated as shown at necropsy, for the walls of the lateral ventricles were covered with a thick greenish fibrinopurulent exudate.

Termination of serum treatment depends upon the general condition of the patient, the temperature curve, and the condition of the spinal fluid. General improvement with persistence of a temperature drop, and removal of clear or nearly clear fluid free from organisms, are indications for stopping treatment. However, as has been explained previously, one should not stop treatment in the first two or three days because of amelioration of symptoms and clearing of fluid until satisfied that there will be no secondary rise in temperature. Ordinarily if the temperature remains down for two days in the face of definite improvement, one may feel justified that it will continue to do so. If the head becomes more retracted under such circumstances, no alarm need be felt. Such a finding seems to indicate successful treatment. It is imperative to have a hypodermic syringe of epinephrin at hand when giving serum for use in case of collapse or anaphylaxis. The amount of serum naturally varies with the severity of the disease, and the course of the disease. In this series of cases the number of punctures ranged between six and ten, with an average of between 150 and 250 cubic centimeters of serum injected. It may be thought that our use of serum was extravagant, but we felt that in the presence of an unusually severe form of the disease it was better to err on the side of overadministration of serum.

Supportive treatment consisted primarily of stimulation when necessary, and of administration of nourishment. The nutrition must be kept up by whatever means necessary, although in our experience tube feeding was extremely in-

frequent. Save for the unconscious, the appetites of the patients were surprisingly good.

Because of the practically universal occurrence of urticaria, beginning usually on the fifth or sixth day, it has become our policy to give epinephrin sulphate in good-sized doses beginning with the third day. Epinephrin by hypodermic was also given when necessary.

#### SPECIAL PROBLEMS

Certain difficulties were encountered from time to time which tested the ingenuity of the medical attendant considerably. During the hysteria of the epidemic two patients were given serum, although the only signs of meningitis present were headache, fever, and a very questionable Kernig, with the spinal fluid normal. Following admission to the hospital the meningeal symptoms were more pronounced and the spinal fluid cloudy—irritation symptoms subsequent to serum administration. In both instances intuitiveness or experience led us to doubt the diagnosis and, aided by the failure to obtain organisms in the fluid, we correctly refused further treatment.

In cases with definite meningeal symptoms, even if the fluid is clear, such as might be found in the meningismus of a pneumonia, one is justified in the presence of an epidemic in using serum if in doubt. One such patient was given two injections of serum until the diagnosis of pneumonia was definite and the course indicated no meningitis.

Patients exhibiting symptoms of meningitis, with cloudy spinal fluid, should be given serum even though no organism is discovered, and serum treatment should be continued until recovery occurs or the diagnosis of another type of meningitis is made. One patient not included in this series showed such findings, with a spinal fluid cell count of 1710, with marked predominance of lymphocytes. The symptoms and findings were those of a mild meningitis. Tuberculosis meningitis, luetic meningitis, and a meningitic form of poliomyelitis could not be diagnosed. The patient was continued on serum treatment and is now cured and awaiting discharge, with normal spinal fluid findings. Jervell's test is negative, indicating no meningeal irritation at this time.

There is one disease which is little considered in the differential diagnosis of meningitis, but which has clouded the diagnosis three times in our experience. This is mumps. Fever, stiffness of the neck, with pain and tenderness on motion, before appreciable swelling of the parotid gland, together with a very suggestive Kernig in a hypertonic child, led us to consider a possible meningitis. In one instance spinal puncture was delayed only because of a suspicious fullness of the neck. It is interesting to note recently that both Fabian<sup>3</sup> and Taillens<sup>4</sup> have described menin-

geal symptoms in mumps. Perhaps in these instances we were dealing with this condition.

#### SUMMARY

Meningitis is an acute illness usually of less than two weeks' duration, with a mortality of approximately 50 per cent, rather than of 30 per cent, as ordinarily given. The age incidence in the series of cases reported showed that the disease predominated in those under ten, but to a much less extent than has been reported in other epidemics. The group from ten to twenty years showed a corresponding increase. The mode of transmission, that is, by close contact, as occurring at dances and athletic contests, makes the high school age unusually susceptible. Prohibition of such activities is much more essential than closing the schools during an epidemic. Those patients who receive treatment early in the course of the disease stand a much better chance of recovery, and those who survive five days of treatment are very likely to recover. Sequelae are not so frequent as heretofore has been thought, and paralyzes are unusually infrequent. The prognosis was favorable if the symptoms subsided early, the temperature dropped and continued to remain down, and the turbidity of the cerebrospinal fluid decreased. Unfavorable signs were continued high fever, continued or progressively cloudy fluid, and signs of increased intracranial pressure or spinal block. Increased retraction of the head in the presence of subsiding symptoms was a favorable sign. Epidemic meningitis requires well organized, systematic and constant nursing and medical attention, and should be handled by institutions regularly equipped to give this service. Administration of serum into the spine is the method of choice in most cases, although in certain severe cases with spinal block and other signs of basilar involvement cisterna puncture is indicated. The method of treatment in this series of cases was midway between the conservative and radical methods. Treatment should not be stopped with subsidence of symptoms and drop in temperature unless the latter remains down for at least two days, as it has been observed in this series of cases that there regularly appears a temporary defervescence with quick elevation of temperature and increase of symptoms. All cases with definite signs of meningitis should be treated as epidemic cerebrospinal meningitis until proven otherwise.

#### CONCLUSIONS

1. A series of seventy-one cases of epidemic cerebrospinal meningitis occurring in the Salt Lake General Hospital is reported.
2. The statistics of this series compare favorably with those from other parts of the country.
3. Sequelae are much less common than is ordinarily supposed.
4. Systematic treatment with constant nursing and medical attention in hospitals equipped for this service should be required.
5. Certain apparently unrecorded observations

are explained and certain problems of diagnosis are discussed.

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### FRACTURE OF THE PELVIS\*

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THIS study of pelvic fractures includes fifty-seven cases from my own practice and sixty-nine cases from the practice of other San Diego men who have kindly given me access to their hospital records. I wish to acknowledge the work of Dr. Louis Strahlman and Dr. Frazer McPherson, who have been associated with me in the orthopedic service at the San Diego County General Hospital.

A classification along anatomical lines is the simplest, as it at once gives the clue for proper treatment.

1. Fracture of the wing of the ilium.
2. Fracture of the sacrum not involving the sacro-iliac joint.
3. Fractures of the rim of the acetabulum associated with dislocation of the hip.
4. Central fractures of acetabulum with inward displacement of the femur.
5. Fracture of an isolated ramus of the pubis or ischium.
6. Fractures involving complete loss of continuity of the pelvic girdle, ranging from fractures of both rami on one side to the most complicated mixtures of fractures of the anterior ring with sacro-iliac separation or break.

This last is the type with which this paper will deal, since it constitutes both the most numerous and most serious of the injuries to the pelvis.

Of these 127 cases, eighty-seven were of this multiple type, and forty were distributed among the other types mentioned. Seventeen were fractures of the ilium. Fourteen were fractures of one ramus. Four were fractures of the acetabulum with backward dislocation of the hip. Three were central fractures of the acetabulum with inward dislocation of the hip. Two were central acetabular breaks without dislocation. One report did not note the location. Ten died, or a mortality of 8 per cent. There were five

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